

WHAT IS CLAIMED IS:

1. A hydrodynamic static mixing apparatus comprising a preselected and predetermined configuration and length of undulating tubular conduit for mixing and/or transporting various substances, including fluids and solids contained in slurries, and said conduit being adapted to be incorporated into systems that perform one or more of the functions of fluid or slurry transport, processing and separation.
2. A hydrodynamic static mixing apparatus as claimed in claim 1 wherein said undulating conduit has a generally helical undulation.
3. A hydrodynamic static mixing apparatus as claimed in claim 1 wherein said undulating conduit has a generally sinusoidal undulation.
4. A hydrodynamic static mixing apparatus as claimed in claims 2 or 3 wherein said undulating conduit has an internally geometric cross-section.
5. A hydrodynamic static mixing apparatus as claimed in claims 2 or 3 wherein said undulating conduit has a generally round internal cross-section.
6. A hydrodynamic static mixing apparatus as claimed in claim 1 wherein the amplitude of said undulation is less than the hydraulic diameter of said conduit.
7. A hydrodynamic static mixing apparatus as claimed in claim 1 wherein the amplitude of said undulation is greater than or equal to the hydraulic diameter of said conduit.
8. A hydrodynamic static mixing apparatus as claimed in claim 1 wherein said undulating conduit has a generally helical undulation of non-zero helical pitch and zero helical radius.
9. A hydrodynamic static mixing apparatus as claimed in claim 8 wherein said undulating conduit has an internally geometric cross-section.

10. A hydrodynamic static mixing apparatus as claimed in claim 8 wherein said undulating conduit has an internally oval cross section.

11. A hydrodynamic static mixing apparatus as claimed in claim 8 wherein said undulating conduit has an internally polygonal cross section.

12. A hydrodynamic static mixing apparatus as claimed in claim 1 wherein said undulating conduit has undulations along its top portion forming the undulating interior.

13. A hydrodynamic static mixing apparatus as claimed in claim 1 wherein said conduit is curved and generally round in cross section.

14. A hydrodynamic static mixing apparatus as claimed in claim 1 wherein said conduit is interposed at various stages of either separate, or simultaneous, transportation, processing and separation of oil-laden fluids in an oil sands bitumen extraction system.

15. A hydrodynamic static mixing apparatus as claimed in claim 1 wherein said conduit has an interior undulating structure at the upper portions thereof, which provide a serpentine path that causes dynamic mixing of its flowing contents due to primary and secondary flow patterns.

16. A method of static mixing of flowing fluids comprising the steps of providing a preselected and predetermined length of undulating interior elongated tubular conduit, connecting said conduit to a conduit of a system providing one or more of the steps of fluid transportation, processing or separation, and pumping fluidized material through said undulating interior elongated tubular conduit at some stage of fluid passage through said system.

17. A method as claimed in claim 16 wherein said stage is an initial mixing stage for conditioning a slurry.

18. A method as claimed in claim 16 wherein said stage is in transportation of a slurry to keep the contents in suspension.

19. A method as claimed in claim 16 wherein said stage is in a transportation pipeline system to revitalize the contents.

20. A method as claimed in claim 16 wherein said stage is in a froth piping system to wash the froth.

21. A method as claimed in claim 16 wherein said undulating interior elongated tubular conduit is interposed at various stages of passage of oil-laden fluids through an oil sands bitumen extraction system.